Nano-Firillar Ceramics by Gas-Phase Reduction

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Nanofibers were formed on the surface of sintered titania (TiO_2) during exposure to the H_2/N_2 gas mixture for 8 h at 700°C (Figure 1a). These nanofibers were ultrasonically removed from specimen surfaces and examined by transmission electron microscopy (TEM). A bright field TEM image of a nanofiber, and an associated selective area electron diffraction (SAED) pattern, are shown in Fig. 1b and c, respectively. SAED analyses of the nanofibers are consistent with the tetragonal crystal structure of rutile. SAED patterns obtained at various positions along the length of a given nanofiber indicate that each nanofiber is comprised of rutile single crystal (note: the rings observed in the SAED pattern in Fig. 1c are generated by the carbon-coated grid used to support the specimen during TEM analyses). Such SAED analyses also reveal that the long dimension (fiber axis) of each nanofiber is parallel to the [001] crystallographic direction of rutile.

The process reported here demonstrates a simple, low-cost method of fabricating nano-structured ceramics as a platform for applications in chemical sensing and photocatalysis. Moreover, this technique may provide a new avenue for micro- and nano-machining of ceramics, which is often a non-trivial task.

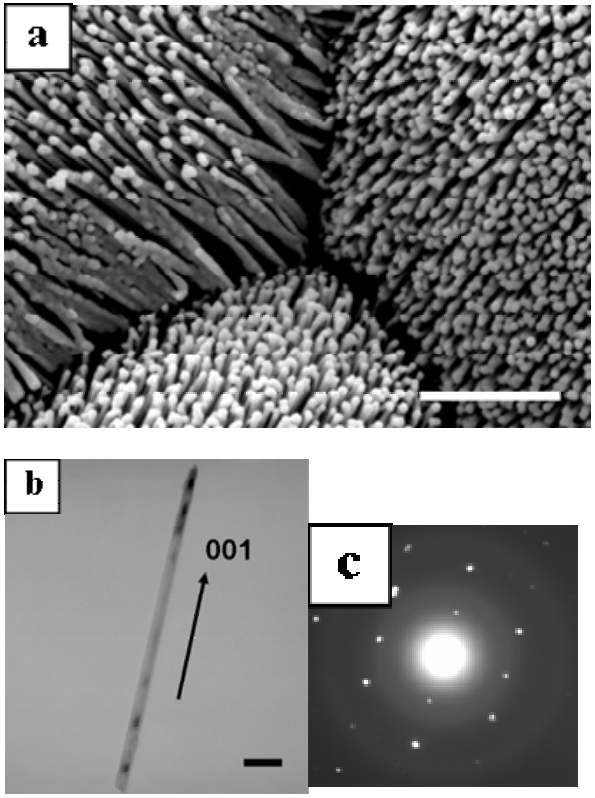

Figure.1: **a**. SEM image of nanofibers, scale bar, 1 μm. **b**. TEM image of a nanofiber, scale bar 200 nm. **c**. Selective area electron diffraction pattern of the nano-fiber.